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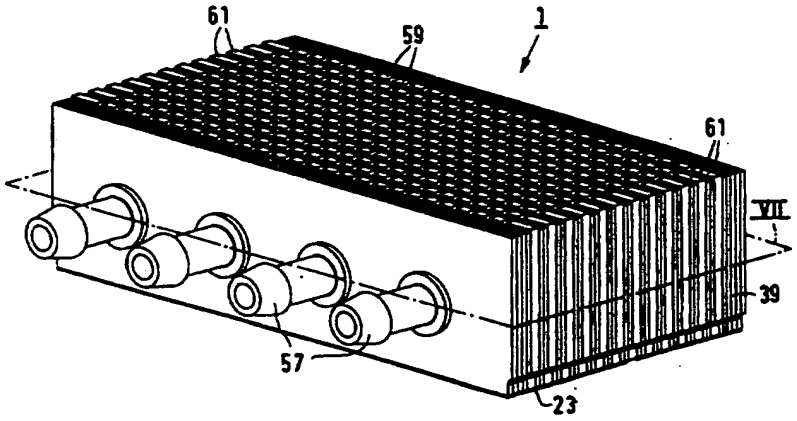

(57) Abstract

The ink jet printer includes a print head (1) with pressure chambers (17), each pressure chamber being formed as a recess in an actuator plate (9) which is bonded by two main faces and a number of side faces, said recess communicating on the one side with an ink supply device (29) and on the other side with a nozzle (25). The nozzles (25) are arranged in a matrix. In the actuator plate (9) there are formed actuator elements (15) which are positioned relative to the pressure chambers (17) in such a manner that, each time a voltage is applied to an actuator element, that actuator element can cooperate with one of the pressure chambers in order to change the volume of the respective pressure chamber. In order to reduce the distance between the nozzles (25), each nozzle opens into a face which coincides with or extends parallel to a first side face (19) of the actuator plate (9) and at least two actuator plates are stacked in such a manner that a block-shaped member (39) is formed and their first side faces form part of a first face of the block-shaped member.

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INK JET PRINTER

The invention relates to an ink jet printer, including a print head with pressure chambers, each pressure chamber being formed as a recess in an actuator plate which is bounded by two main faces and a number of side faces, said recess communicating on the one side with an ink supply device and on the other side with a nozzle, said nozzles being arranged in a matrix, in the actuator plate there being formed actuator elements which are positioned relative to the pressure chambers in such a manner that, each time a voltage is applied to an actuator element, that actuator element can cooperate with one of the pressure chambers in order to change the volume of the pressure chamber.

An ink jet printer of this kind is known from WO-A-96/14 987. Because the nozzles are arranged in a matrix, information can be printed with a resolution which is higher than could be achieved if only a single row of nozzles were used. The pressure chambers in the known device have an elongate shape and are oriented in such a manner that their longitudinal direction coincides with the direction of the rows of the matrix. Consequently, the distance between successive nozzles is comparatively large in this direction, that is to say larger than the length of the pressure chamber. In order to enable uninterrupted printing of characters across the entire width of a record carrier nevertheless, the nozzles in successive rows of the matrix are arranged so as to be staggered. The number of rows required per color to be reproduced is then dependent on the desired resolution. In an embodiment described in the cited document the number of rows amounts to six per color. At least 24 rows are then required for the four colors customarily used in multicolor printing (black, cyan, magenta and yellow). This number is even larger if a higher resolution is required. Because of the large number of rows of nozzles required, the dimensions of the print head are larger than desirable in many cases.

It is an object of the invention to provide an ink jet printer of the kind set forth in which the dimensions of the print head can be substantially smaller than in the known ink jet printer for a given resolution and a given number of colors to be printed. To this end, the ink jet printer according to the invention is characterized in that each of the nozzles opens into a face which coincides with or is parallel to a first side face of the actuator plate, and that at least two actuator plates are stacked so that they form a block-

shaped member in such a manner that their first side faces form part of a first face of the block-shaped member. If the actuator plate has a rectangular shape, as is usually the case, the largest dimension of the pressure chambers will generally extend in a direction parallel to the two main faces and two oppositely situated side faces. The longitudinal direction of the pressure chambers thus extends perpendicularly to the other two side faces, in one of which the nozzles are situated. The distance between these nozzles is then determined mainly by the transverse dimension of the pressure chambers and the associated actuator elements, which transverse dimension is generally substantially smaller than the length of the pressure chambers. The thickness of the actuator plates is approximately equal to this distance so that, after the stacking of the actuator plates, a face of the resultant block-shaped member has a high nozzle density, for example 1 nozzle per mm^2.

A first embodiment of the ink jet printer according to the invention is characterized in that each of the nozzles is formed as a through-opening in a nozzle plate which is arranged against the pressure chambers so that a wall of each pressure chamber is formed by a part of the nozzle plate, that each of the pressure chambers has a discharge opening in the first side face of the actuator plate, and that the nozzle plate is arranged against the first face of the block-shaped member in such a manner that each of the discharge openings is aligned with one of the nozzles. This embodiment offers the advantage that no severe requirements need be imposed as regards the dimensional accuracy of the discharge openings. The nozzles can be readily formed in the nozzle plate with a high accuracy.

A further embodiment of the ink jet printer according to the invention is characterized in that every two stacked actuator plates in the block-shaped member are separated from one another by a separating plate which extends parallel to the main faces of the actuator plates. The pressure chambers are formed in the actuator plates in a manner which is known per se, for example by sawing, ultrasound drilling, etching, powder blasting or another suitable method, for example as mentioned in WO-A-96/14 988. Generally speaking, the pressure chambers thus formed are open in the direction of at least one of the main faces of the actuator plate. The open side of a pressure chamber could in principle be covered by the next actuator plate in the stack, but it has been found that in many cases it is advantageous to use a separating plate for this purpose. This is the case, for example when the pressure chambers are open towards both main faces of the actuator plate.

In order to prevent crosstalk between the actuator elements, generally speaking, mechanical decoupling of these elements is desired. For example, in WO-A-96/14 988 it is explained that this can be advantageously achieved by means of slit-

shaped separating openings formed in the actuator plate and extending across the entire thickness of the actuator plate. The actuator plate is thus subdivided into a number of fingers, each finger being provided with an actuator element with a pressure chamber. If the actuator plates were simply stacked, a given degree of coupling could occur between actuator elements of successive actuator plates in the stacking direction. Moreover, some of the actuator elements of the same actuator plate could again be coupled to one another via the block-shaped member formed by stacking. This can be simply prevented in the latter embodiment of the ink jet printer according to the invention. To this end, an alternative version of this embodiment is characterized in that at the location of the separating openings in the adjacent actuator plate each separating plate is provided with corresponding separating openings which extend through the entire thickness of the separating plate, and that at the location of the actuator elements of the adjacent actuator plate, each separating plate is provided with a recess which extends through a part of the thickness of the separating plate. In this version there is a clearance all around the fingers in which the actuator elements and the pressure chambers are situated.

A further version of said embodiment is characterized in that each actuator plate is situated between a separating plate which is arranged against a first main face and a channel plate which is arranged against a second main face and in which an ink channel which constitutes a connection between the ink supply device and the relevant pressure chamber is recessed for each pressure chamber present in the actuator plate. An ink supply channel which, generally speaking, must satisfy comparatively severe requirements in respect of accuracy can be more readily formed in a separate channel plate than in the actuator plate itself. For the reasons given above it is advantageous if at the location of the separating openings in the engaging actuator plate the channel plate is provided with corresponding separating openings which extend through the thickness of the channel plate.

A further embodiment of the ink jet printer according to the invention is characterized in that against one of the main faces of each actuator plate there is arranged a channel plate which constitutes a wall of the pressure chambers in the actuator plate and is provided, at the location of each pressure chamber, with a first opening which communicates with the pressure chamber and forms part of the connection between the pressure chamber and the ink supply device, and with a second opening which communicates with the pressure chamber, and that against the channel plate there is arranged a cover plate whose main face facing the channel plate is provided with a recess which constitutes, in conjunction with the second opening in the channel plate, the nozzle associated with the pressure chamber. This

embodiment offers the advantage that the construction is simple and that the number of different components required is comparatively small.

In order to facilitate the connection of the first and second electrodes, each actuator element is preferably electrically connected to contact members in the form of metallized connection pads on a second side face of the actuator plate.

It has been found that an ink jet printer having a high-quality print head which can be comparatively easily manufactured is obtained if the actuator elements formed in the actuator plates are ceramic multilayer actuators (CMAs) and if at least one of the other plates used in the print head is made of glass.

These and other aspects of the invention will become apparent from and elucidated with reference to the embodiments described hereinafter.

In the drawings:

Fig. 1 shows a simplified block diagram of an embodiment of an ink jet printer according to the invention,

Fig. 2 is a side elevation of a part of a first embodiment of a print head for the ink jet printer shown in Fig. 1,

Fig. 3 is a sectional view taken along the line III-III in Fig. 2,

Fig. 4 is a sectional view taken along the line IV-IV in Fig. 2,

Fig. 5 is a sectional view taken along the line V-V in Fig. 2,

Fig. 6 is a perspective view of the first embodiment of a print head for the ink jet printer shown in Fig. 1,

Fig. 7 is a cross-sectional view of a part of the print head shown in Fig. 6,

Fig. 8 is a side elevation of a part of a second embodiment of a print head for the ink jet printer shown in Fig. 1,

Fig. 9 is a sectional view taken along the line IX-IX in Fig. 8, and

Fig. 10 is a sectional view taken along the line X-X in Fig. 8.

Fig. 1 is a block diagram with only the most essential parts of an ink jet printer according to the invention. The printer includes a print head 1, a paper transport device 3, and a control unit 5. The construction of ink jet printers is generally known, for example from WO-A-96/14 987. The device according to the invention deviates from the known devices mainly in that the construction of the print head 1 is different.

As opposed to the print head of the known ink jet printer, consisting of a single actuator plate, the print head 1 of the ink jet printer according to the invention consists

of a stack of actuator plates. Fig. 2 is a side elevation of an assembly of one of these actuator plates with a separating plate and a channel plate. The Figs. 3 and 4 are sectional views taken along the line III-III and along the line IV-IV in Fig. 2, respectively. Fig. 5 is a sectional view, taken along the line V-V, of the assembly shown in Fig. 2. The assembly 7 shown is a sandwich in which the actuator plate 9 is arranged between the separating plate 11 and the channel plate 13. The actuator plate 9 is a flat plate of a suitable material, preferably a material containing an alternation of number of layers of a piezoelectric ceramic material and electrode layers. The first, third, fifth etc. electrode layers are connected so as to form a first electrode, and the second, fourth, sixth etc. electrode layers are connected so as to form a second electrode (not shown). This construction is described in greater detail in WO-A-96 14 987. The actuator plate 9 is thus provided with ceramic multilayer actuators (CMAs), some of which are denoted by the reference 15 in the Figs. 2 and 5. Furthermore, the actuator plates 9 are provided with pressure chambers 17 by forming recesses in the actuator plate by means of a suitable method (for example, powder blasting, ultrasonic drilling or another known method). Each of these recesses is enclosed by one of the actuator elements 15, each actuator element comprising two parts which are situated to both sides of the recess. Consequently, each actuator element 15 cooperates with one of the pressure chambers 17 so as to change the volume of the pressure chamber when a suitable voltage is applied to (the electrodes of) the actuator element. The foregoing is described in detail in WO-A-96/14 988 and WO-A-96/14 987.

Each actuator plate 9 is bounded by two main faces which extend parallel to the plane of drawing of Fig. 2. and four side faces which extend perpendicularly to the plane of drawing of Fig. 2. The main faces extend horizontally and the side faces extend vertically in the Figs. 3 to 5. The separating plate 11 is arranged against the first main face (at the top in the Figs. 3 to 5) and the channel plate 13 is arranged against the second main face. In the embodiment shown, the pressure chambers 17 extend through the entire thickness of the actuator plate 9, i.e. from the first main face to the second main face. At the area of these main faces the pressure chambers 17 are bounded by the separating plate 11 and the channel plate 13 which, if desired, may be provided, both, with a recess (not shown) at the area of each pressure chamber in order to increase the volume of the pressure chamber. It is alternatively possible to form the pressure chambers 17 as recesses which extend into the actuator plate 9 over a given distance from one of the main faces, without reaching as far as the other main face. As is shown in the Figs. 2 and 3, the pressure chambers 17 have an elongate shape and their longitudinal direction extends parallel to the main faces and

perpendicularly to a first side face which is denoted by the reference 19 in the Figs. 2 and 4. Each pressure chamber 17 opens into a discharge opening 21 in the first side face 19. A nozzle plate 23 with nozzles 25 is arranged against the first side face 19. Each discharge opening 21 is aligned with respect to one of the nozzles 25, so that the pressure chamber 17 communicates with the nozzle 25 via the discharge opening 21. At its end which is remote from the first side face 19 the pressure chamber 17 is connected to an ink channel 27 which is recessed in the channel plate 13 in the present embodiment. The ink channel connects the pressure chamber 17 to an ink supply channel 29 which forms part of an ink supply device which may also include an ink reservoir (not shown). Fig. 2 clearly shows that the ink channel 27 includes a constricted portion 27a. This portion serves to prevent the pressure wave, appearing upon actuation of the actuator element 15, from propagating to the ink supply device. As has already been explained in the cited documents, this pressure wave serves for the ejection of an ink droplet via the nozzle 25 and it will be evident that the energy required for generating the pressure wave is most effectively used if the pressure wave cannot travel to the ink supply device.

Evidently, the aim is for each actuator element 15 to produce a pressure wave in only one pressure chamber 17 upon excitation, so that an ink droplet is ejected only by the nozzle connected to the relevant pressure chamber. Therefore, the actuator elements 15 in the actuator plate 9 are mechanically decoupled from one another by means of slit-shaped separating openings 31 which extend through the entire thickness of the actuator plate and over the entire length of the adjacent actuator elements. Consequently, each actuator element 15 with the associated pressure chamber 17 provided therein is situated in a finger-like portion of the actuator plate 9 which is connected to the other finger-shaped portions, via a non-interrupted portion of the actuator plate, only at its end which is remote from the first side face 19. The decoupling thus created could be partly canceled again by the presence of the separating plate 11 and the channel plate 13. In order to prevent this, these plates have a special shape. At the area of the separating openings 31 in the actuator plate 9 the separating plate 11 is provided with corresponding separating openings 33 which extend through the entire thickness of the separating plate, so that no direct coupling is established between neighboring actuator elements 15 via the separating plate. Because the assembly 7 is to be stacked together with other, similar assemblies during a further stage of the construction of the print head 1 (as will be described in detail hereinafter), coupling between the neighboring actuator elements 15 could occur as yet via the separating plate 11 and the next assembly in the stack which is arranged against the separating plate. In order to preclude this possibility,

the separating plate 11 is also provided with a recess 35. In the same way as the separating plate 11, the channel plate 13 is provided with corresponding separating openings 37 at the area of the separating openings 31 in the actuator plate 9, said separating openings 37 preventing coupling between the actuator elements directly via the channel plate. The separating plate 11 and the channel plate 13 are preferably made of glass in which the various recesses can be provided, for example by etching. The glass plates can be readily connected to the ceramic actuator plate 9, for example by gluing or in the manner described in WO-A-96/05606 of the same date. Evidently, other materials, for example a suitable metal such as nickel or a suitable synthetic material, can also be used for the separating plate 11 and the channel plate 13.

As has already been stated, the print head 1 is formed by stacking a number of assemblies 7 as shown in the Figs. 2 to 5 so as to form a block-shaped member. Fig. 6 is a perspective view of such a member and Fig. 7 is a sectional view of a part of this member, taken in a plane denoted by the reference VII in Fig. 6. As is clearly shown in fig. 7, the block-shaped member 39, forming part of the print head 1, includes a stack consisting of a number of assemblies 7, amounting to twelve in this case. The stack is formed so that the first side faces 19 of the actuator plates 9 form part of a first face of the block-shaped member 39 which faces downwards in Fig. 6. The nozzle plate 23 is arranged against this first face of the block-shaped member 39. The nozzle plate 23 comprises a number of nozzles 25 which is equal to the total number of pressure chambers 17 in all actuator plates 9 which together constitute the block-shaped member 39. The nozzles 25 are arranged in a matrix in such a manner that each of the discharge openings 21 is aligned with respect to one of the nozzles.

Fig. 7 shows that a separating plate 11 and a channel plate 13 are arranged between every two stacked actuator plates 9, said three plates extending in parallel. Evidently, it would also be possible to combine the channel plate 13 and the separating plate 11 so as to form a single plate. If the recesses constituting the pressure chambers 17 do not extend through the entire thickness of the actuator plate 9, the separating plate 11 and the channel plate 13 may then be even completely omitted. In that case the pressure chambers 17 can extend from one main face to a given depth into the actuator plate 9 whereas the ink channels 27 extend from the other main face. At the upper side of Fig. 7 (near the rear of the block-shaped member 39 in Fig. 6) the stack of actuator plates 9 terminates into a rear plate 43 which is arranged against the last channel plate and is provided with a recess which extends through a part of the thickness of the rear plate and has a function similar to that of

the recesses in the separating plates 11. The rear plate 43 may be succeeded yet by one or more end plates 47. At the top in Fig. 7 (the front face of the block-shaped member in Fig. 6) the stack terminates in an ink passage plate 49 and an ink supply plate 51 on which there is arranged an ink connection plate 53. The ink passage plate 49 and the ink supply plate 51 are provided with recesses which together constitute a system of channels 55 which can be connected to an ink reservoir (not shown) via a tube connection tower 57 mounted on the ink connection plate 53. The system of channels 55 itself communicates with the ink supply channel 29. In the embodiment shown, the print head 1 includes four systems of channels 55, each of which has its own tube connection tower 57. This print head, therefore, is suitable for multi-color printing, one of the colors black, cyan, magenta and yellow being supplied to each system of channels 55. A very compact color print head can thus be manufactured. The number of pressure chambers 17 per actuator plate 19 amounts to, for example 24 and the number of actuator plates 9 in the print head 1 may amount to 12, like in the embodiment shown. The number of nozzles then amounts to 288 and the dimension of such a print head is, for example 28 x 14 x 9 mm^3.

The previously mentioned first and second electrodes of each actuator element 15 are electrically connected, via conductors (not shown) which extend in the actuator plate 9, to contact members which are formed as metallized connection pads on a second side face of the actuator plate which is situated opposite the first side face 19 in the present embodiment. In Fig. 6 these connection pads are visible on the upper surface of the block-shaped member 39 and are denoted by the reference numerals 59 and 61. For each actuator element 15 there is provided a respective first contact member 59, a second contact member 61 being common to all actuator elements in an actuator plate 9. The contact members can be connected to the control unit 5 (Fig. 1) via a connection plate provided with a similar pattern of connection pads (not shown). If desired, all second contact members can be interconnected already on the block-shaped member 39.

Fig. 8 is a side elevation of an assembly consisting of an actuator plate, a channel plate and a cover plate, said assembly forming part of a second embodiment of a print head for the device shown in Fig. 1. Figs. 9 and 10 are sectional views taken along the lines IX-IX and X-X, respectively, in Fig. 8. Corresponding reference numerals are used for corresponding parts. The actuator plate 9 is formed essentially in the same way as the actuator plate in the first embodiment. It comprises similar actuator elements 15 and pressure chambers 17. A channel plate 13 is arranged against the second main face of the actuator plate (at the bottom in the Figs. 9 and 10), said channel plate constituting a wall of the

pressure chambers 17. At the area of each pressure chamber 17, the channel plate 13 is provided with a first opening 63 which connects the pressure chamber to the ink supply channel 29 via an ink channel 27 which is recessed in the main face of the channel plate which is remote from the actuator plate 9. A second opening 65 also constitutes a connection between the pressure chamber and the main face of the channel plate 13 which is remote from the actuator plate. A cover plate 67 is arranged against the main face of the channel plate 13 which is remote from the actuator plate 9, the main face of said cover plate 67 which faces the channel plate 13 being provided with a recess 69 which constitutes, in conjunction with the second opening 65 in the channel plate, the nozzle 25 associated with the pressure chamber 17. Similar to the first embodiment, the channel plate 13 is provided with separating openings 37. At areas corresponding to the separating openings 37, the cover plate 67 is also provided with separating openings 71.

CLAIMS:

1. An ink jet printer, including a print head (1) with pressure chambers (17), each pressure chamber being formed as a recess in an actuator plate (9) which is bounded by two main faces and a number of side faces, said recess communicating on the one side with an ink supply device (29) and on the other side with a nozzle (25), said nozzles being arranged in a matrix, in the actuator plate there being formed actuator elements (15) which are positioned relative to the pressure chambers in such a manner that, each time a voltage is applied to an actuator element, that actuator element can cooperate with one of the pressure chambers in order to change the volume of the pressure chamber, characterized in that each of the nozzles (25) opens into a face which coincides with or is parallel to a first side face (19) of the actuator plate (9), and that at least two actuator plates are stacked so that they form a block-shaped member (39) in such a manner that their first side faces form part of a first face of the block-shaped member.

2. An ink jet printer as claimed in Claim 1, characterized in that each of the nozzles (25) is formed as a through-opening in a nozzle plate (23) which is arranged against the pressure chambers (17) so that a wall of each pressure chamber is formed by a part of the nozzle plate, that each of the pressure chambers has a discharge opening (21) in the first side face (19) of the actuator plate (9), and that the nozzle plate is arranged against the first face of the block-shaped member in such a manner that each of the discharge openings is aligned with one of the nozzles (25).

3. An ink jet printer as claimed in Claim 2, characterized in that every two stacked actuator plates (9) in the block-shaped member (39) are separated from one another by a separating plate (11) which extends parallel to the main faces of the actuator plates.

4. An ink jet printer as claimed in Claim 3, in which adjoining actuator elements (15) in each of the actuator plates (9) are mechanically uncoupled from one another by means of slit-shaped separating openings (33) formed in the actuator plate and extending through the entire thickness of the actuator plate, characterized in that at the location of the separating openings (31) in the adjacent actuator plate (9) each separating plate (11) is provided with corresponding separating openings (33) which extend through the entire thickness of the separating plate, and that at the location of the actuator elements of the

adjacent actuator plate each separating plate is provided with a recess (35) which extends through a part of the thickness of the separating plate.

5. An ink jet printer as claimed in Claim 3 or 4, characterized in that each actuator plate (9) is situated between a separating plate (11), which is arranged against a first main face, and a channel plate (13), which is arranged against a second main face and in which an ink channel (27), which constitutes a connection between the ink supply device (27) and the relevant pressure chamber, is recessed for each pressure chamber (17) present in the actuator plate.

6. An ink jet printer as claimed in Claim 5, in which adjoining actuator elements (15) in each of the actuator plates (9) are mechanically uncoupled from one another by means of slit-shaped separating openings (31) formed in the actuator plate and extending through the entire thickness of the actuator plate, characterized in that at the location of the separating openings (31) in the engaging actuator plate (9) the channel plate (13) is provided with corresponding separating openings (37) which extend through the thickness of the channel plate.

7. An ink jet printer as claimed in Claim 1, characterized in that against one of the main faces of each actuator plate (9) there is arranged a channel plate which constitutes a wall of the pressure chambers (17) in the actuator plate and is provided, at the location of each pressure chamber, with a first opening which communicates with the pressure chamber and forms part of the connection between the pressure chamber and the ink supply device (29), and with a second opening which communicates with the pressure chamber, and that against the channel plate there is arranged a cover plate whose main face facing the channel plate is provided with a recess which constitutes, in conjunction with the second opening in the channel plate, the nozzle associated with the pressure chamber.

8. An ink jet printer as claimed in any one of the preceding Claims, characterized in that each actuator element (15) is electrically connected to contact members (59, 61) in the form of metallized connection pads on a second side face of the actuator plate (9).

9. An ink jet printer as claimed in any one of the preceding Claims, characterized in that the actuator elements (15) formed in the actuator plates (9) are ceramic multilayer actuators (CMAs), and that at least one of the other plates (11, 13) used in the print head is made of glass.

10. A print head for use in an ink jet printer as claimed in any one of the preceding Claims.

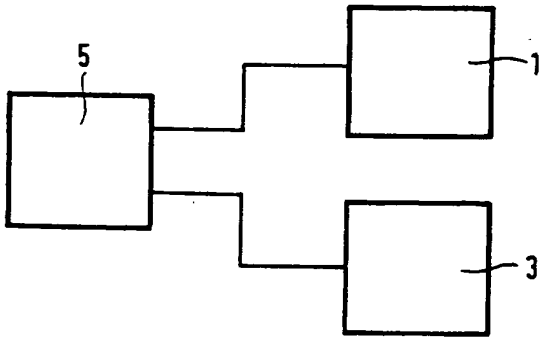
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FIG.1

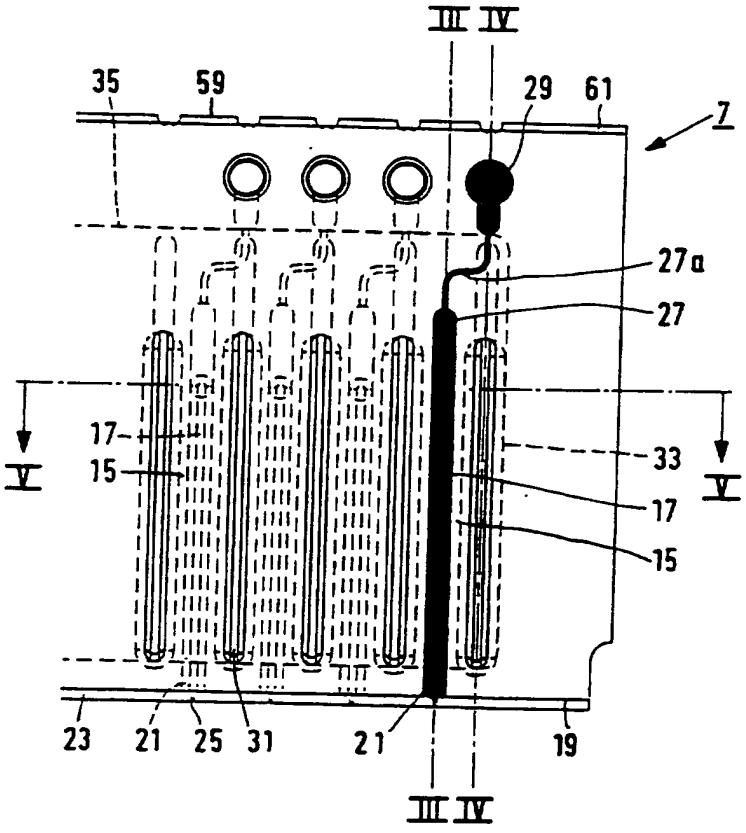
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FIG.2

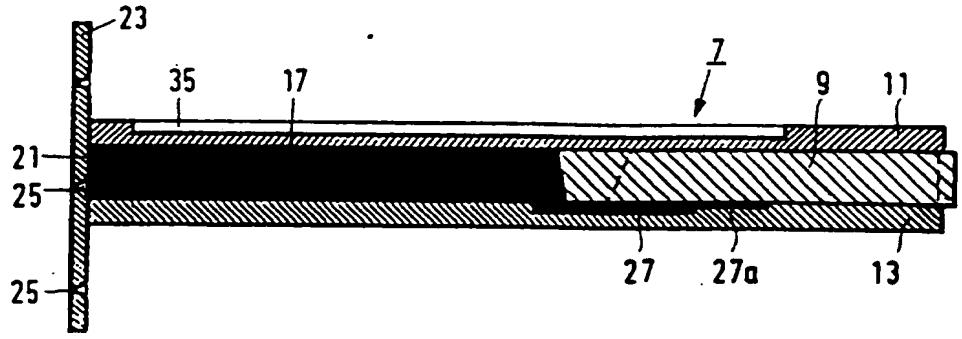

FIG.3

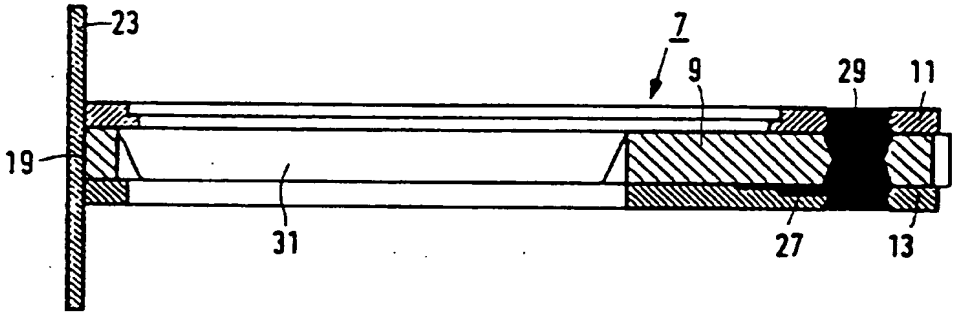

FIG.4

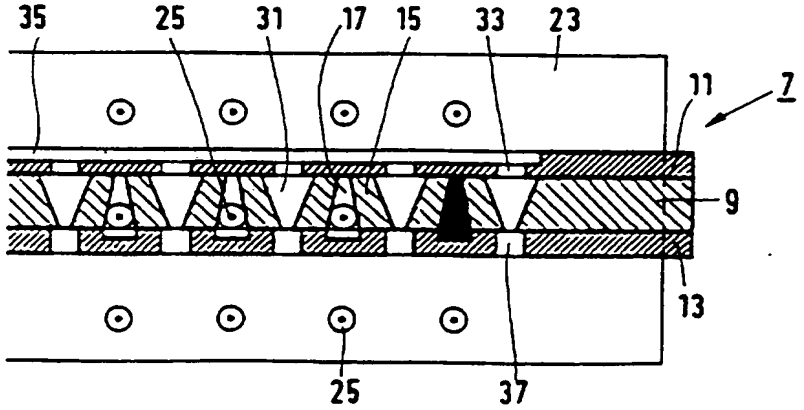

FIG.5

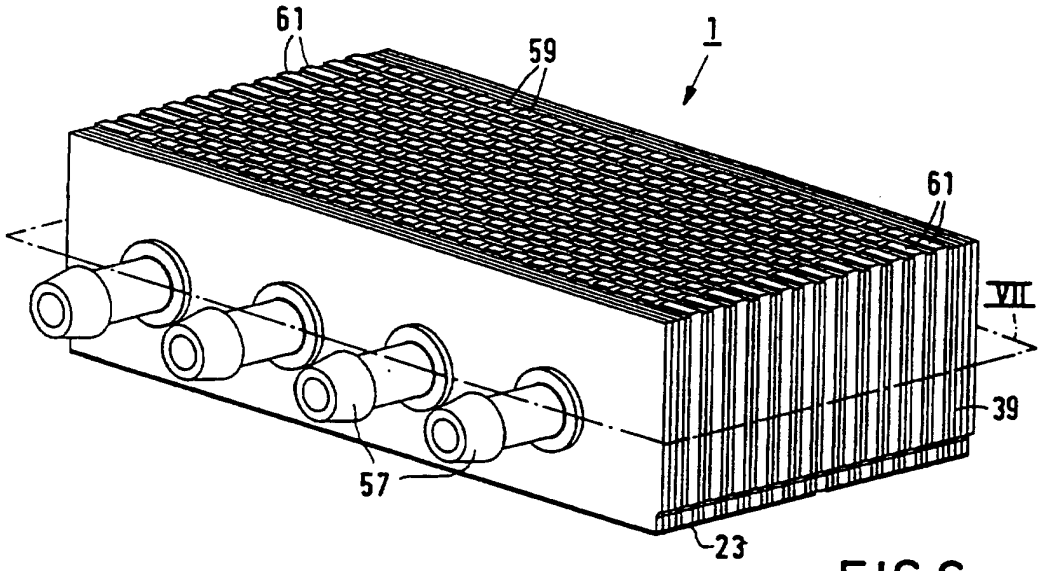

FIG.6

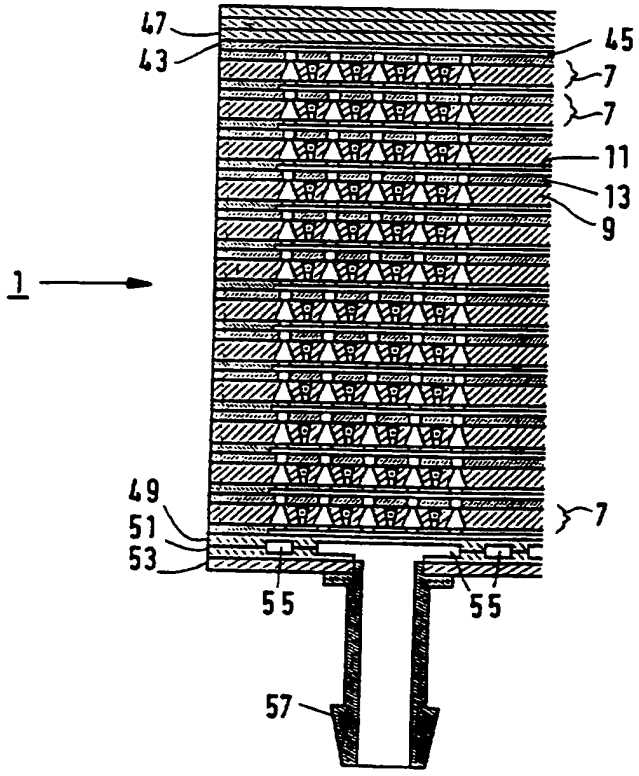

FIG.7

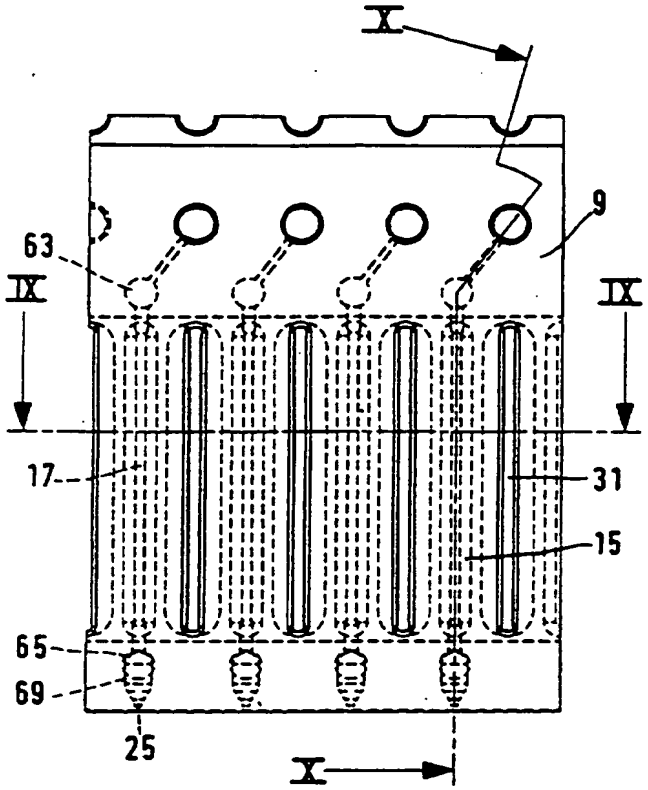

FIG.8

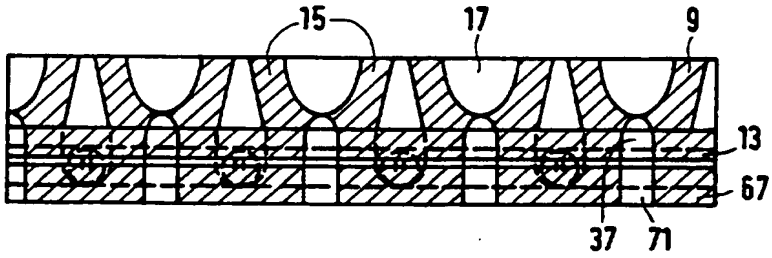

FIG.9

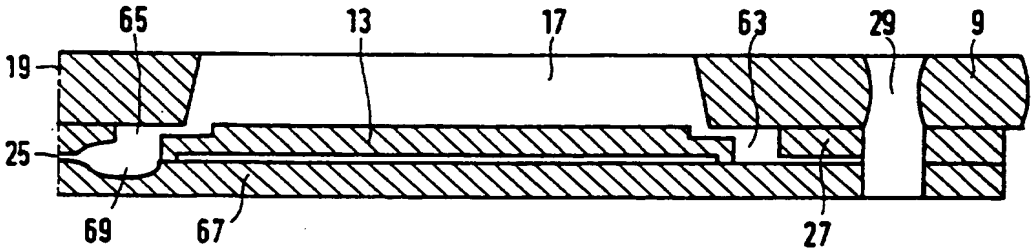

FIG.10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB 97/00809

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B41J 2/045
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B41J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5227813 A (JOHN R. PIES ET AL), 13 July 1993 (13.07.93)	2-10
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X	US 4536097 A (KENTH NILSSON), 20 August 1985 (20.08.85)	1
Y		2-10
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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 January 1998	16 -01 1998
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Jan Silfverling Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/97

International application No.
PCT/IB 97/00809

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